EXPOSURE AND TOXICITY ASSESSMENT FOR REDUCING TOBACCO HARM

Source: https://www.industrydocuments.ucsf.edu/docs/tjgk0001

Smoke Exposure

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PM3001144070

Source: https://www.industrydocuments.ucsf.edu/docs/tjgk0001

Chemical Analysis of Tobacco Smoke

CDC

Analysis of Tobacco Smoke

Why measure the constituents of tobacco smoke?

What are the compounds of concern in tobacco smoke?

What factors are important in measuring tobacco smoke constituents?

What are the challenges to meaningful measures in smoke?

CDC

Why do we need to know the constituents of tobacco smoke?

Cigarettes are highly developed devices.

Smoke generation is a very complex process that must be experimentally evaluated.

Tar, nicotine and CO measurements do not accurately describe the levels of other toxic agents in tobacco smoke.

Chemical composition of smoke from new products is a crucial first step in evaluating their potential harm.

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What we know – Constituents of Tobacco Smoke

Tobacco smoke contains approximately 4000 chemical compounds.

There are a finite number of chemicals in smoke that are generally agreed upon as of concern.

These include carcinogenic, toxic, and addictive compounds and others that can or are suspected to alter the harm or bioavailability of compounds of concern.

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Chemicals of biological concern have been identified by previous groups

Hoffmann list
British Columbia list
Massachusetts list
NIOSH list
Surgeon General's report

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Carcinogens

N-nitrosamines (11)

Polyaromatic hydrocarbons (10)

Aromatic amines (4)

Volatiles (acetaldehyde, acrolein, acrylonitrile, benzene, formaldehyde, vinyl chloride)

Heavy metals (arsenic, beryllium, cadmium, chromium, nickel, polonium-210)

Aza-arenes (4)

N-heterocyclic amines (8)

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Toxins

Gases (carbon monoxide, nitrogen oxides, hydrogen cyanide, cyanogen, carbon disulfide, hydrogen sulfide, 1,3-butadiene, ethylene oxide)

Volatiles (isoprene, phenol, styrene, toluene)

Heavy metals (cobalt, lead, mercury)

Pesticides and agricultural treatments (maleic hydrazide, ethyl carbamate, methyl isocyanate, DDE, DDT, etc.)

Miscellaneous organics (acrylamide, aniline, crotonaldehyde, 1,1-dimethylhydrazine, nitrobenzene, pyridine)

Addictive, Enhance Bioavailability, or Facilitate Use

Nicotine

Ammonia

Acetaldehyde

Flavor-related compounds

Humectants (propylene glycol, cocoa, sugars, licorice, etc)

What we know – Analysis of Tobacco Smoke

Levels of smoke constituents change as smoking parameters change.

Levels of smoke constituents change as cigarette design changes.

Chemicals in smoke can exist in the gas and/or particulate phase.

Mainstream and sidestream smoke have different constituent levels.

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How can we use tobacco smoke analysis?

- Can be used to examine the effects of chemical and physical changes on smoke chemistry
- Can evaluate the smoke constituent yields in products at a specific smoking regimen to compare to other brands of similar tar and nicotine yield.
- Cannot be used alone to assess population exposure
- Cannot be used alone to calculate population risk

What are the challenges to meaningful measures in smoke?

- Develop methods that address specific analytical questions. The needs for research and regulation are different.
- Obtain sensitivity, accuracy, precision, reliability, and ruggedness at low cost.
- Ensure that the smoke is collected properly so that it is indicative of smoke to which people are exposed.

What are the challenges to meaningful measures in smoke?

- Understand the factors controlling transfer between the gas and particulate phase.
- Account for the differences between sidestream and mainstream smoke.
- Take into account mixed chemical effects instead of assuming that each constituent acts independently.

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What are the challenges to meaningful measures in smoke?

Take a product that can be used in different ways and account for that variability.
- all people do not smoke the same
- each person does not smoke different products the same
- compensation

Take fully into account cigarette design complexity and its effect on smoke constituents.

Account for storage on retail shelves and changes over time.

Include major changes that alternative products will introduce.

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We do know:
- current constituents of concern
- that levels change with cigarette design and smoking topography

We do not know:
- how chemicals interact
- what new chemicals of concern will arise
- how to account for design and usage effects
- how to properly collect biologically-meaningful smoke samples
- how measurements translate into human health risk

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Any harm reduction strategy must combine the efforts of tobacco analysis, smoke analysis, smoking topography evaluation, biomarkers, bioassays, and health outcome measures.

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Top 5 Research Questions

How do chemical interactions affect the biological availability and toxicity/carcinogenicity of smoke constituents?

How do chemical constituents alter the way that people smoke?

Will lower harmful smoke constituents result in lower human biological levels and thus, lower *morbidity* and *mortality*?

What product design factors most affect the toxicity/carcinogenicity of cigarette smoke?

What new chemicals of concern will arise from new tobacco products?

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